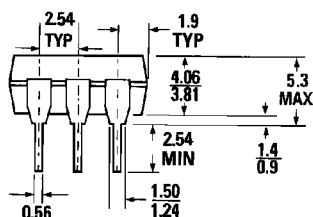
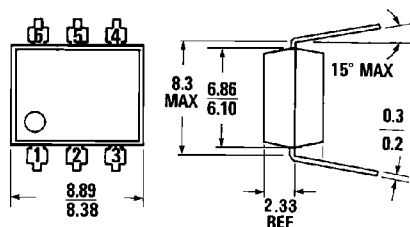




PHOTOTRANSISTOR OPTOISOLATOR

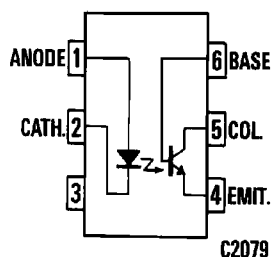
TIL111

PACKAGE DIMENSIONS



DIMENSIONS IN mm
PACKAGE CODE K

ST1603A



DESCRIPTION

The TIL111 is a phototransistor-type optically coupled isolator. An infrared emitting diode manufactured from specially grown gallium arsenide is selectively coupled with an NPN silicon phototransistor. The device is supplied in a standard plastic six-pin dual-in-line package.

FEATURES

- Underwriters Laboratory (UL) recognized File #E90700

APPLICATIONS

- Power supply regulators
- Digital logic inputs
- Microprocessor inputs
- Appliance sensor systems
- Industrial controls

ABSOLUTE MAXIMUM RATINGS ($T_A = 25^\circ\text{C}$ Unless Otherwise Specified)

TOTAL PACKAGE

Storage temperature	-55°C to 150°C
Operating temperature	-55°C to 100°C
Lead temperature	
(soldering, 10 sec)	260°C
Total package power dissipation at 25°C	
(LED plus detector)	260 mW
Derate linearly from 25°C	3.3 mW/ $^\circ\text{C}$

INPUT DIODE

Forward DC current	100 mA
Reverse voltage	3 V
Peak forward current	
(1 μs pulse, 300 pps)	3.0 A
Power dissipation 25°C ambient	150 mW
Derate linearly from 25°C	2 mW/ $^\circ\text{C}$

OUTPUT TRANSISTOR

Power dissipation at 25°C	150 mW
Derate linearly from 25°C	2 mW/ $^\circ\text{C}$
V_{CE0}	30 V
V_{CBO}	70 V
V_{ECO}	7 V
Collector current (continuous)	100 mA

ELECTRICAL CHARACTERISTICS (At 25°C Free-Air Temperature)

INDIVIDUAL COMPONENT CHARACTERISTICS

PARAMETER	SYMBOL	TIL111			UNIT	TEST CONDITIONS
		MIN.	TYP.	MAX.		
INPUT DIODE Input diode static reverse current	I_R			10	μA	$V_R = 3 V$
Input diode static forward voltage	V_F		1.2	1.4	V	$I_F = 16 mA$
OUTPUT TRANSISTOR Collector-base breakdown voltage	$V_{(BR)CBO}$	70			V	$I_C = 10 \mu A, I_E = 0, I_F = 0$
Collector-emitter breakdown voltage	$V_{(BR)CEO}$	30			V	$I_C = 1 mA, I_B = 0, I_F = 0$
Emitter-base breakdown voltage	$V_{(BR)EBO}$	7			V	$I_F = 10 \mu A, I_C = 0, I_E = 0$
Transistor static forward current transfer ratio	h_{FE}	100	300			$V_{CE} = 5 V, I_C = 10 mA, I_F = 0$

TRANSFER CHARACTERISTICS

PARAMETER	SYMBOL	TIL111			UNIT	TEST CONDITIONS
		MIN.	TYP.	MAX.		
On-state collector current	Phototransistor operation $I_{C(on)}$	2	7		mA	$V_{CE} = 0.4 V, I_F = 16 mA, I_B = 0$
	Photodiode operation $I_{C(on)}$	7	20		μA	$V_{CB} = 0.4 V, I_F = 16 mA, I_E = 0$
Off-state collector current	Phototransistor operation $I_{C(off)}$		1	50	nA	$V_{CE} = 10 V, I_F = 0, I_B = 0$
	Photodiode operation $I_{C(off)}$		0.1	20		$V_{CB} = 10 V, I_F = 0, I_E = 0$
Collector-emitter saturation voltage	$V_{CE(sat)}$		0.25	0.4	V	$I_C = 2 mA, I_F = 16 mA, I_B = 0$

SWITCHING CHARACTERISTICS (At 25°C Free-Air Temperature)

PARAMETER	SYMBOL	TIL111			UNIT	TEST CONDITIONS
		MIN.	TYP.	MAX.		
Rise time	Phototransistor operation t_r		5	10	μs	$V_{CC} = 10 V, I_{C(on)} = 2 mA, R_L = 100 \Omega$
Fall time	Phototransistor operation t_f					
Rise time	Photodiode operation t_r		1		μs	$V_{CC} = 10 V, I_{C(on)} = 20 \mu A, R_L = 1 k\Omega$
Fall time	Photodiode operation t_f					

ISOLATION CHARACTERISTICS

PARAMETER	SYMBOL	TIL111			UNIT	TEST CONDITIONS
		MIN.	TYP.	MAX.		
Input-to-output internal resistance	r_{io}	10^{11}			Ω	$V_{iso} = \pm 1.5 kV$
Input-to-output capacitance	C_{io}		1	1.3	pF	$V_{in-out} = 0, f = 1 MHz, \text{See Note 6}$
Isolation voltage	V_{iso}	7500 5300			VAC-PEAK	$I_{io} \leq 1 \mu A, 1 \text{ minute}$
					VAC-RMS	$I_{io} \leq 1 \mu A, 1 \text{ minute}$

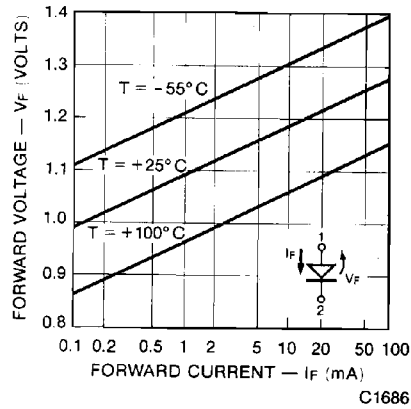


Fig. 1. Forward Voltage vs. Current

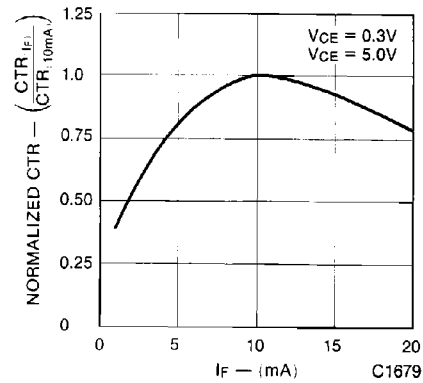


Fig. 2. Normalized CTR vs. Forward Current

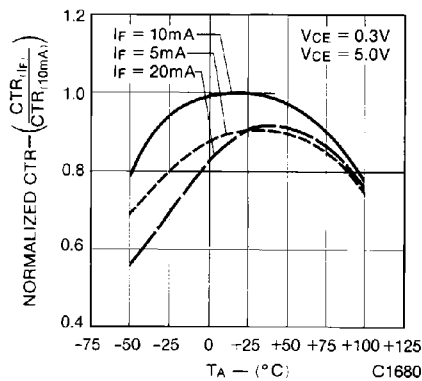


Fig. 3. Normalized CTR vs. Temperature

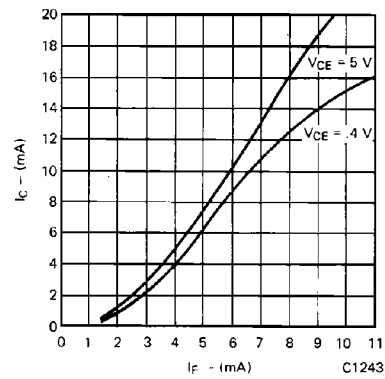


Fig. 4. Collector Current vs. Forward Current

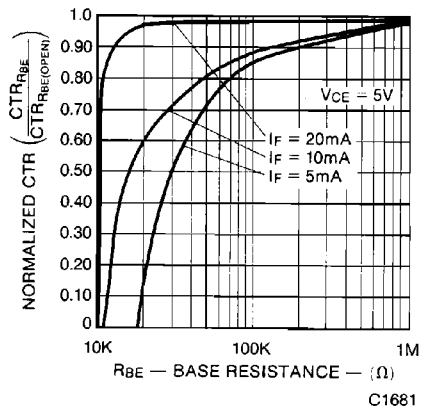


Fig. 5. CTR vs. R_{BE} (Unsaturated)

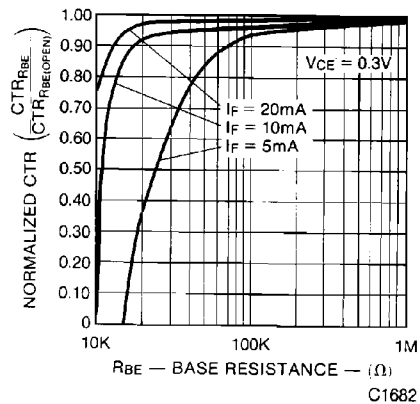


Fig. 6. CTR vs. R_{BE} (Saturated)

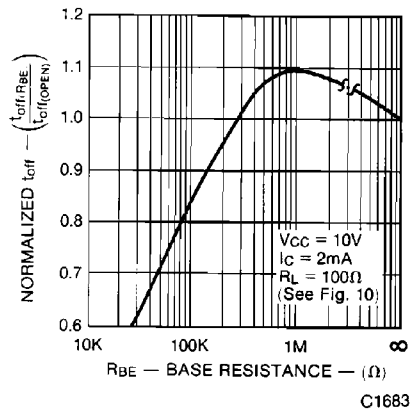


Fig. 7. Normalized T_{OFF} vs. R_{BE}

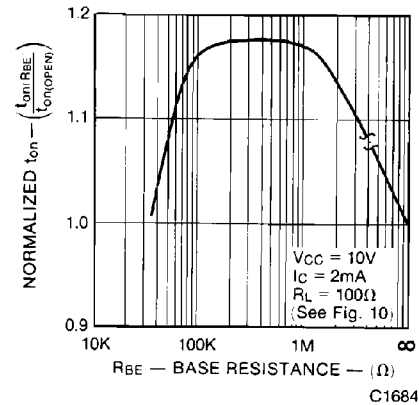


Fig. 8. Normalized T_{ON} vs. R_{BE}

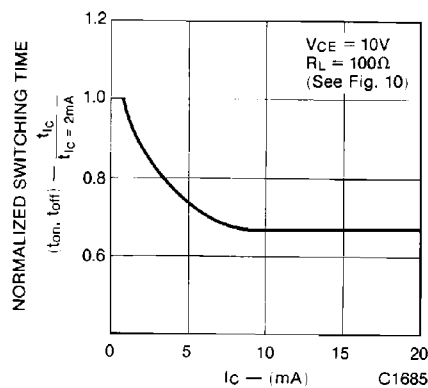


Fig. 9. Switching Time vs. I_C

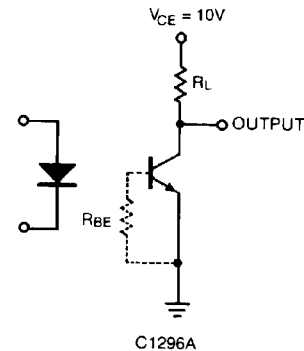


Fig. 10. Switching Time Test Circuit

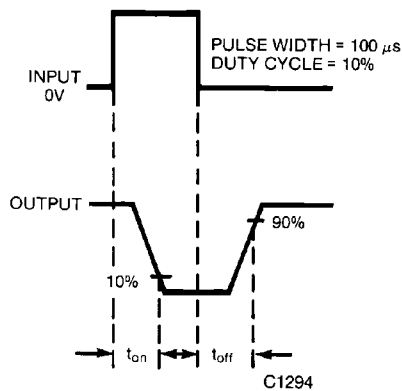


Fig. 11. Switching Time Waveforms